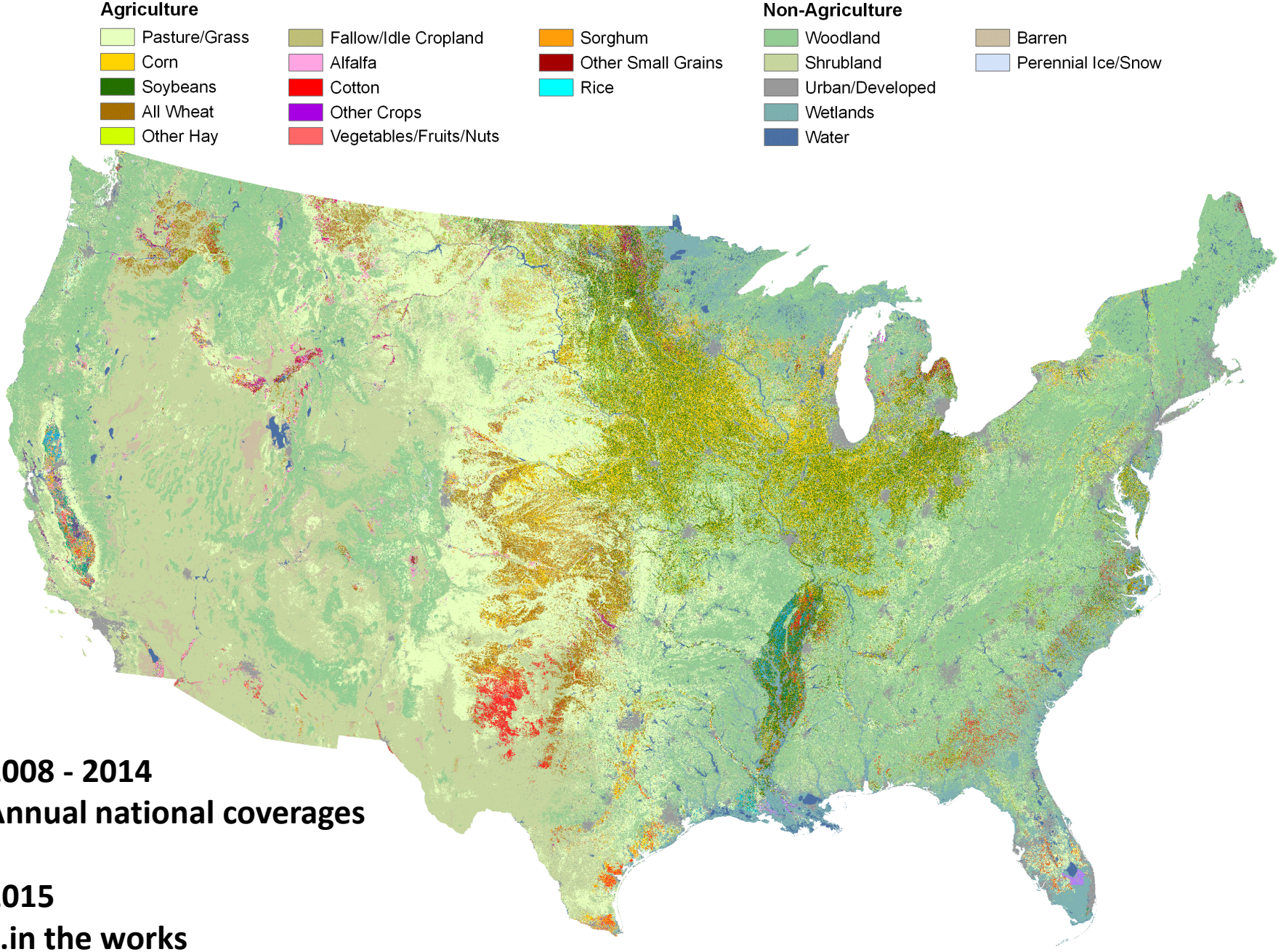
Can Landsat Yield Crop Yields?

(and some other discussion topics too)

David M. Johnson, USDA National Agricultural Statistics Service

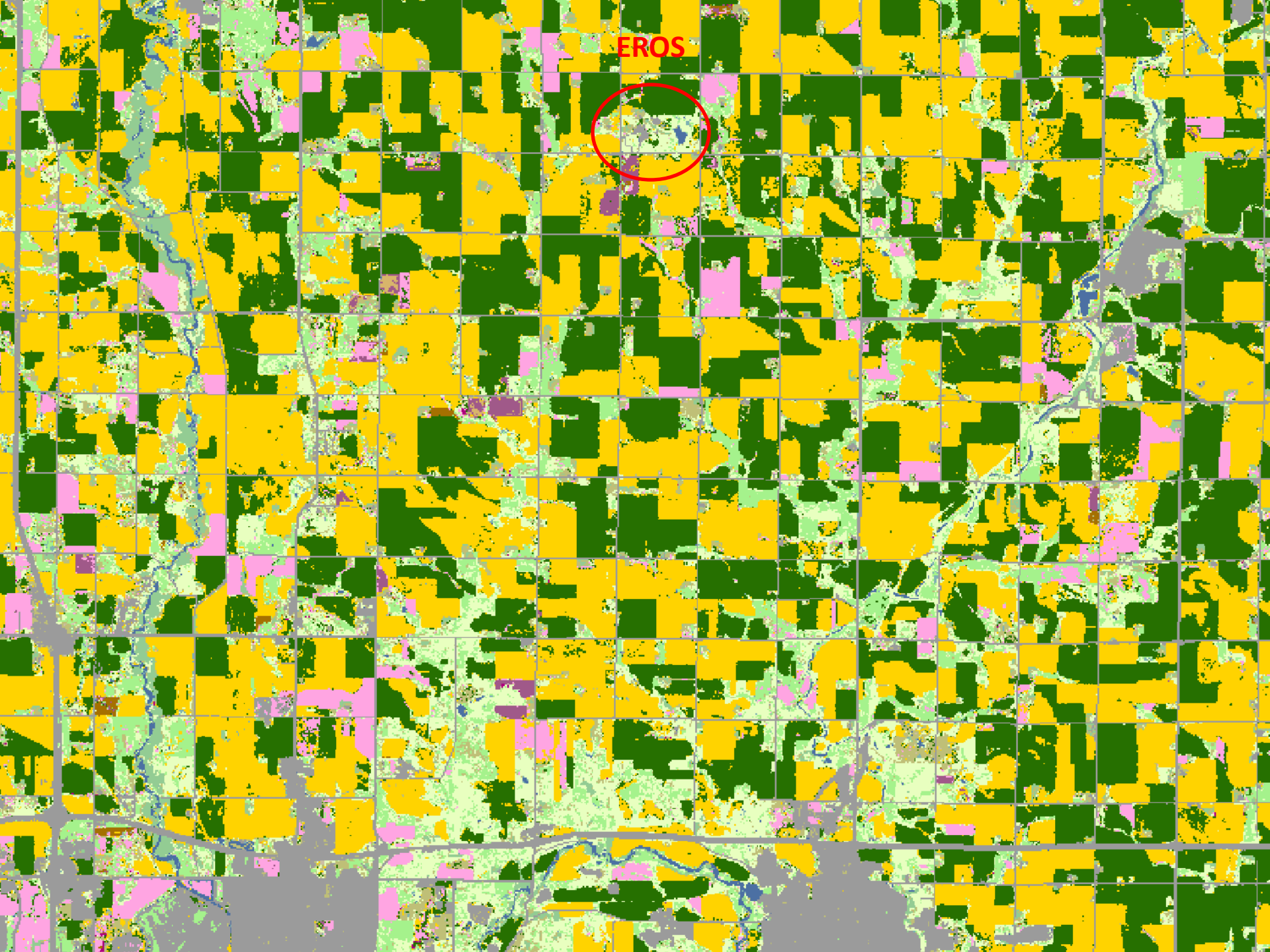
Landsat Science Team, Summer 2015 Meeting, USGS/EROS

Cropland Data Layer (CDL)

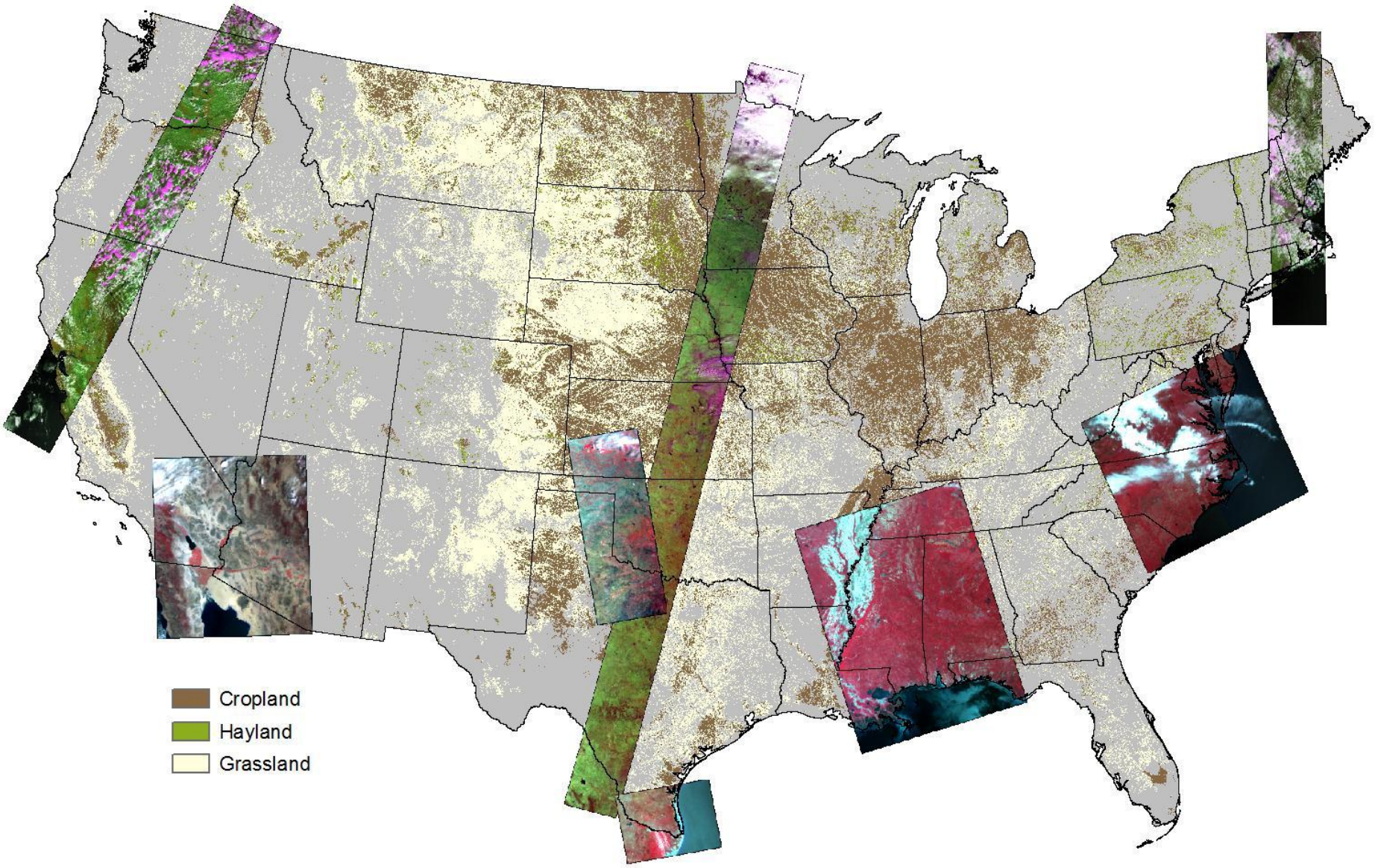


2008 - 2014
Annual national coverages

2015
…in the works

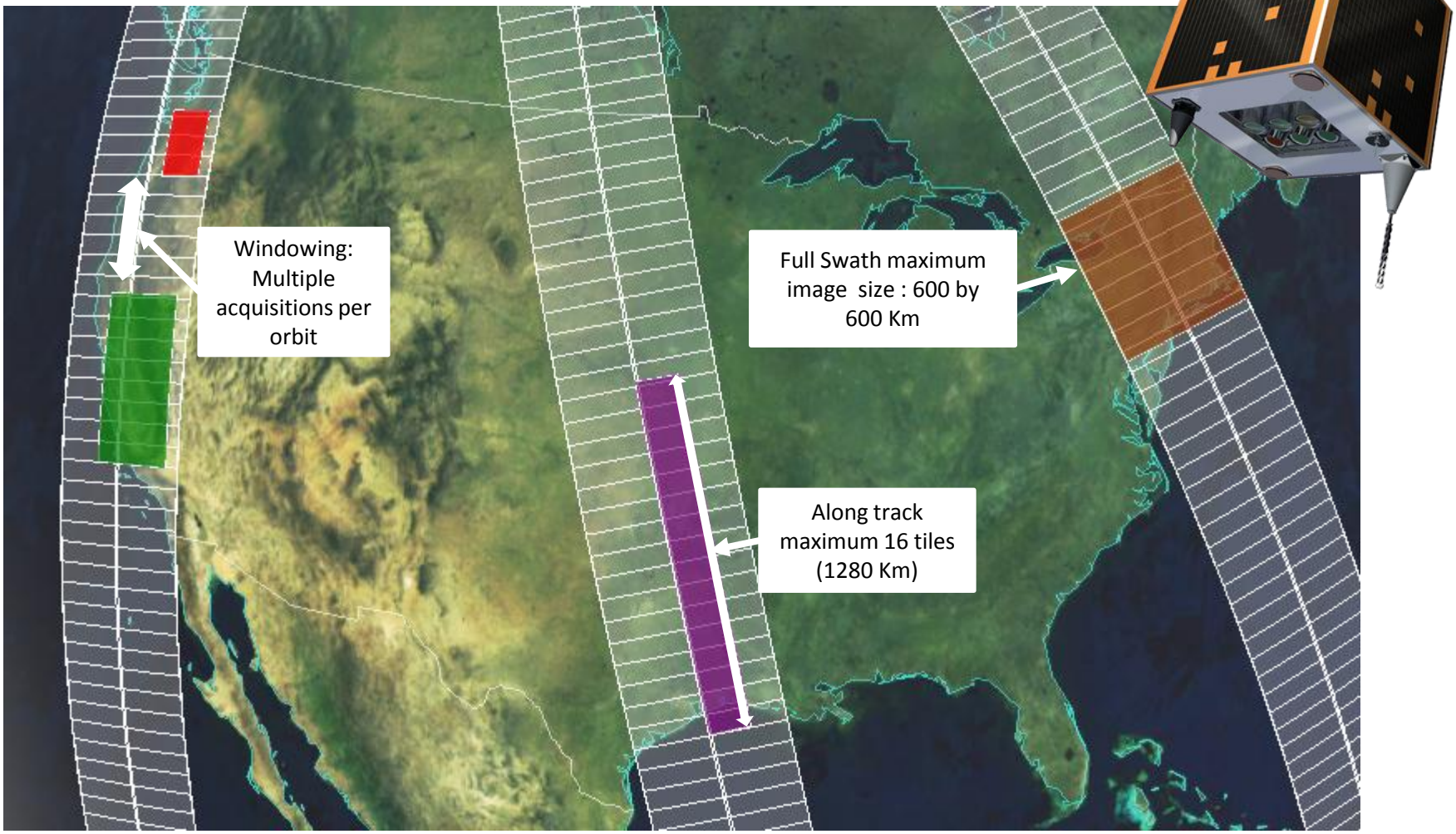

EROS

Example Single day of collects

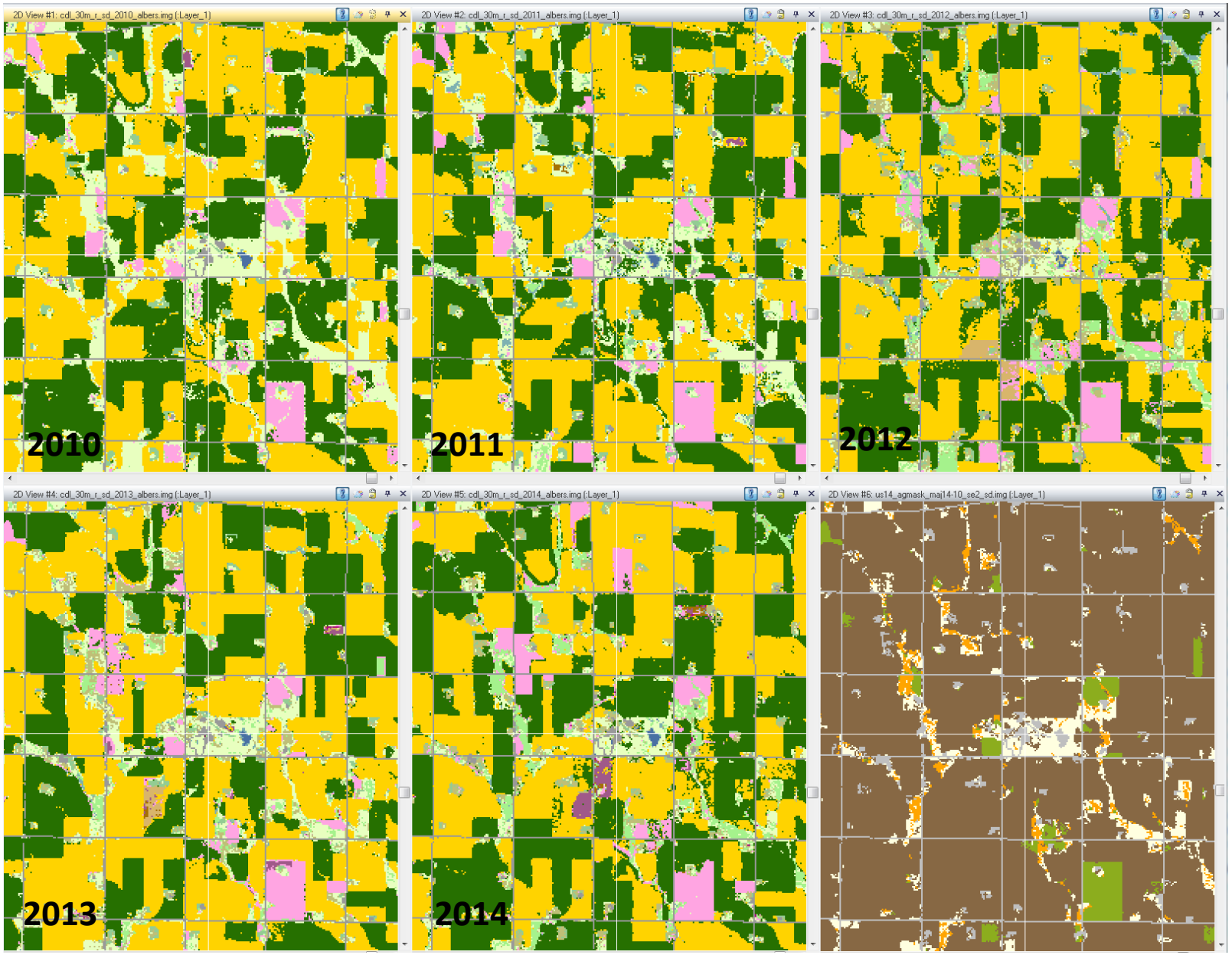


Disaster Monitoring Constellation (DMC) satellites Deimos-1 and UK2

Low cost “smallsat” with color-infrared 22m resolution

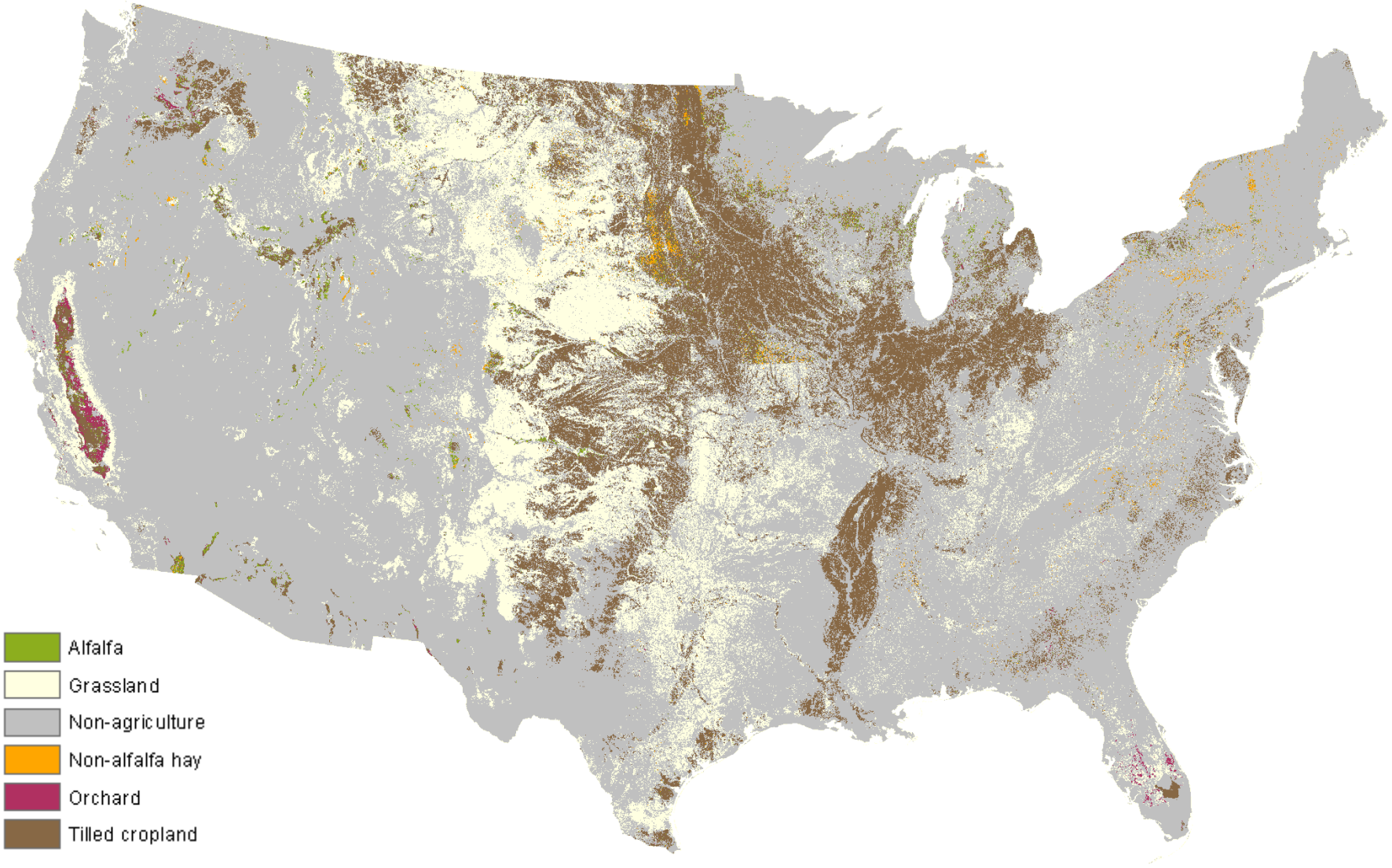


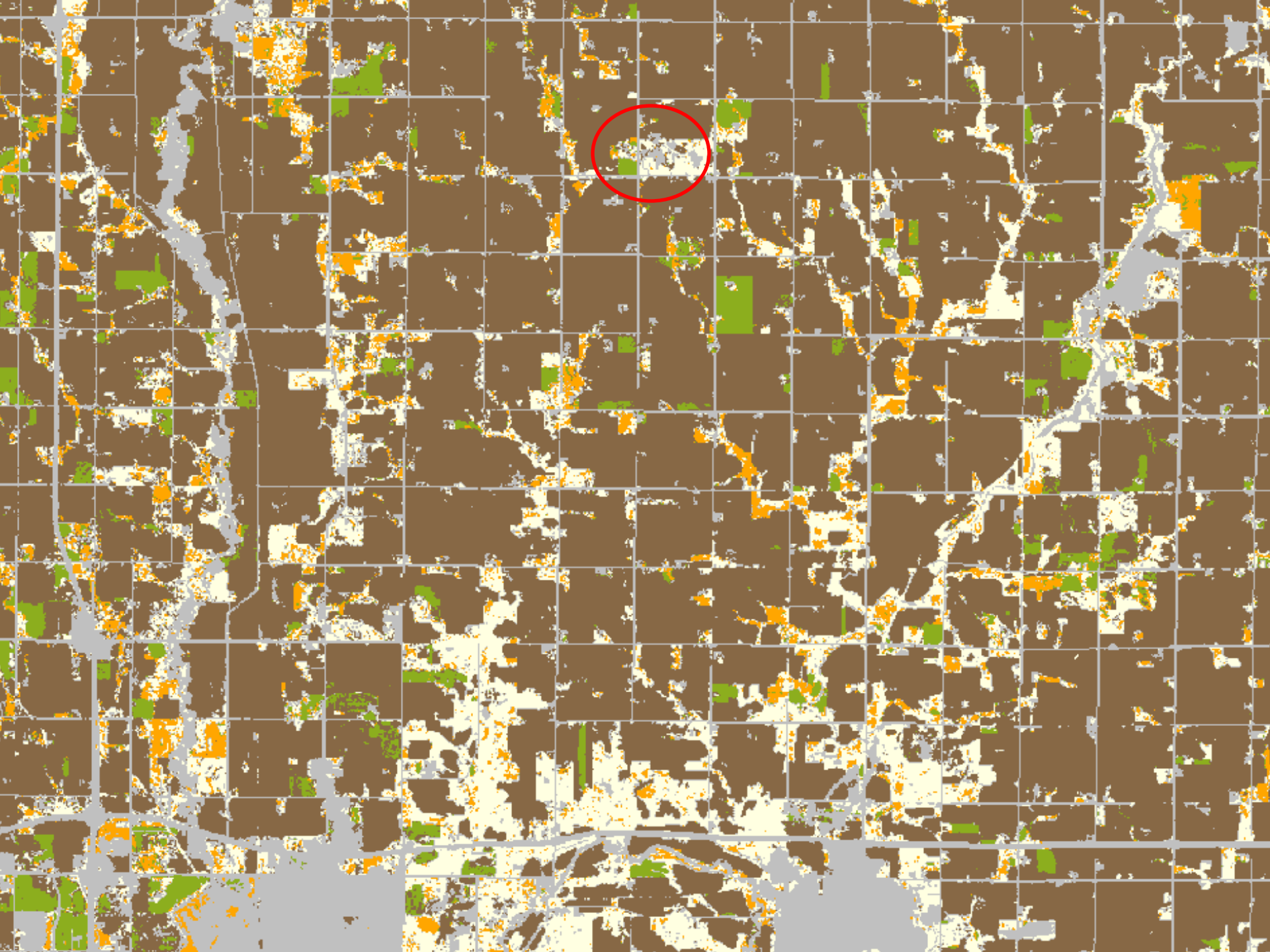
2010 – 2014 CDLs, EROS and surroundings



Agricultural Data Layer

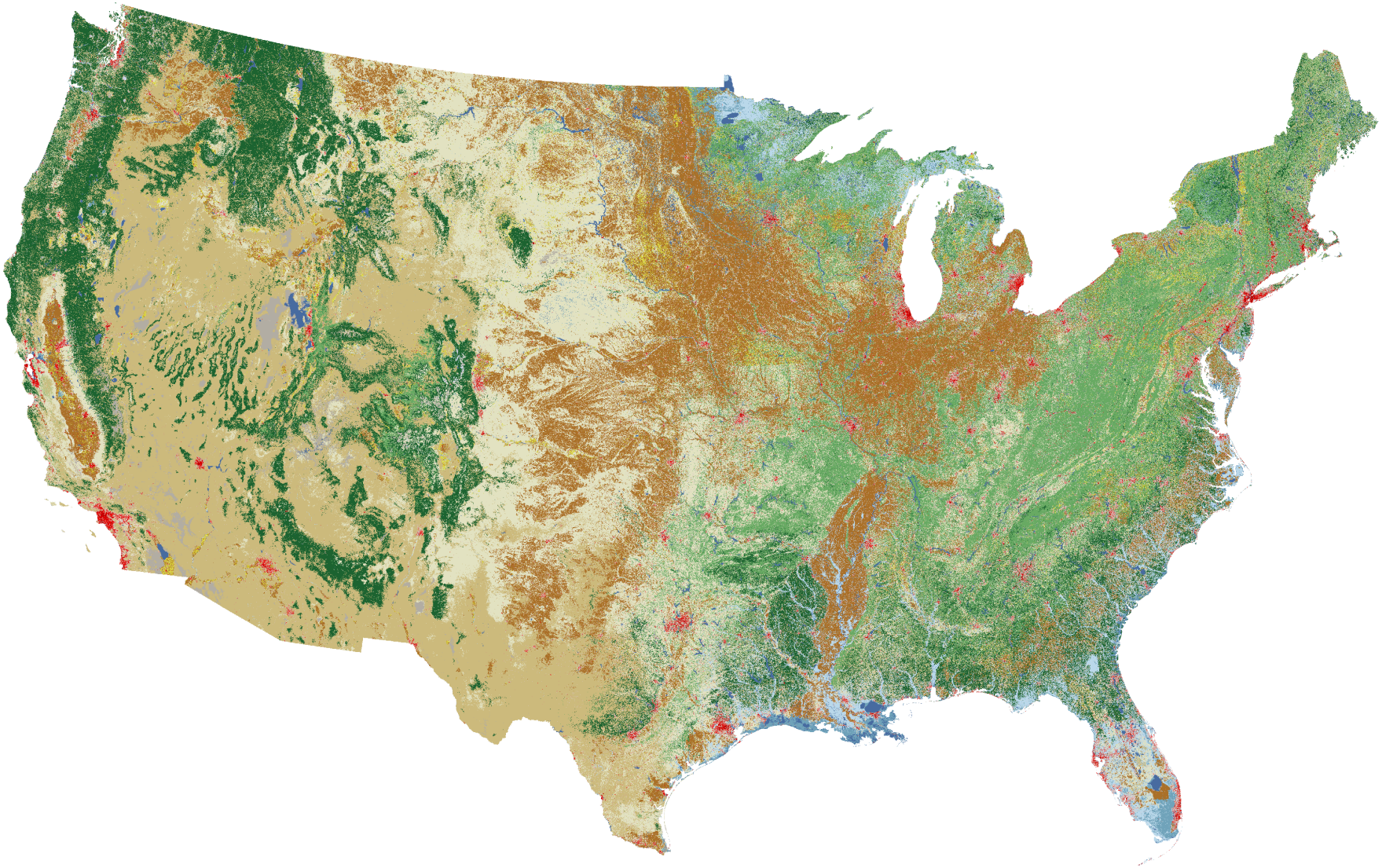
2010 – 2014 CDL recode and majority vote





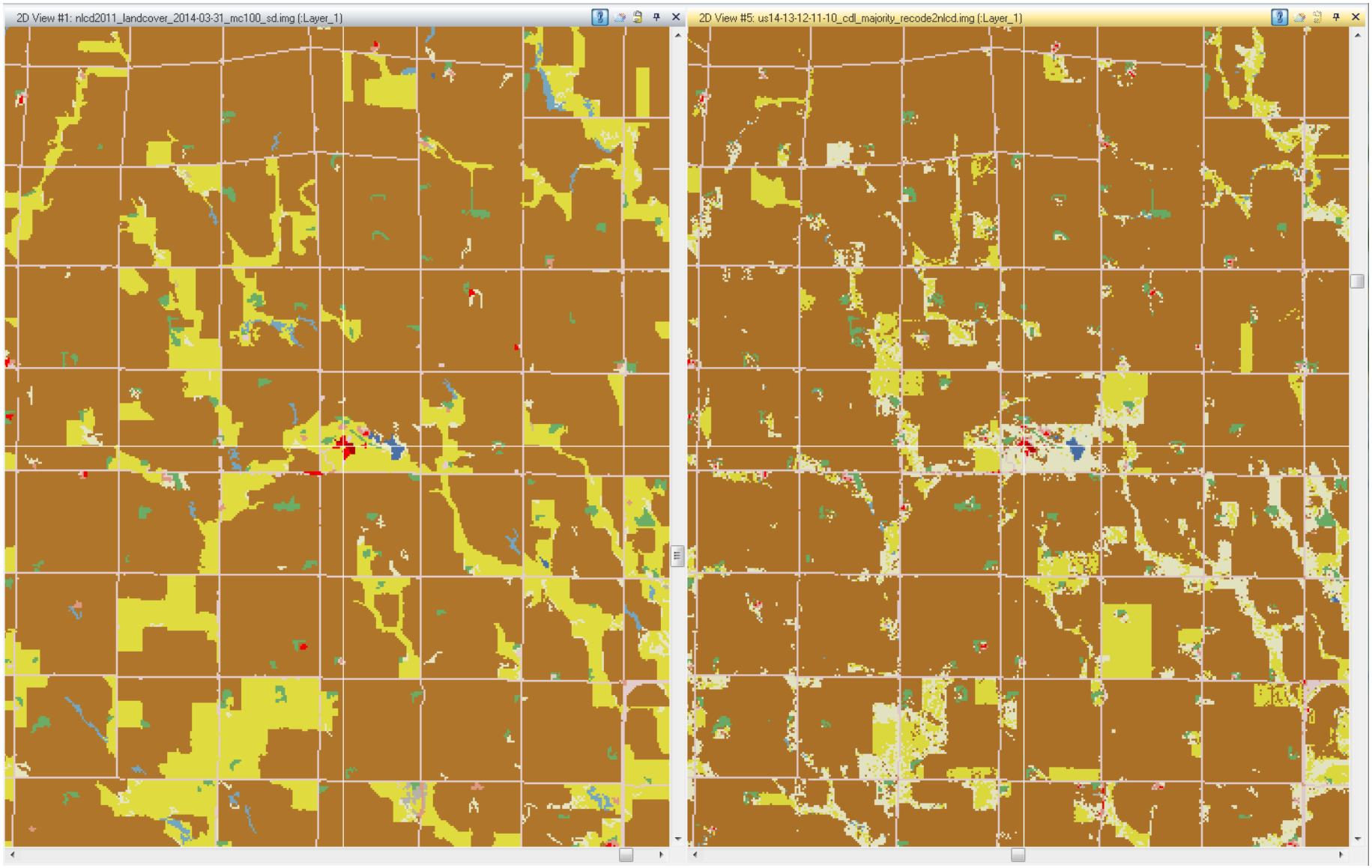
Faux 2012 NLCD

2010 – 2014 CDL majority vote and crosswalk

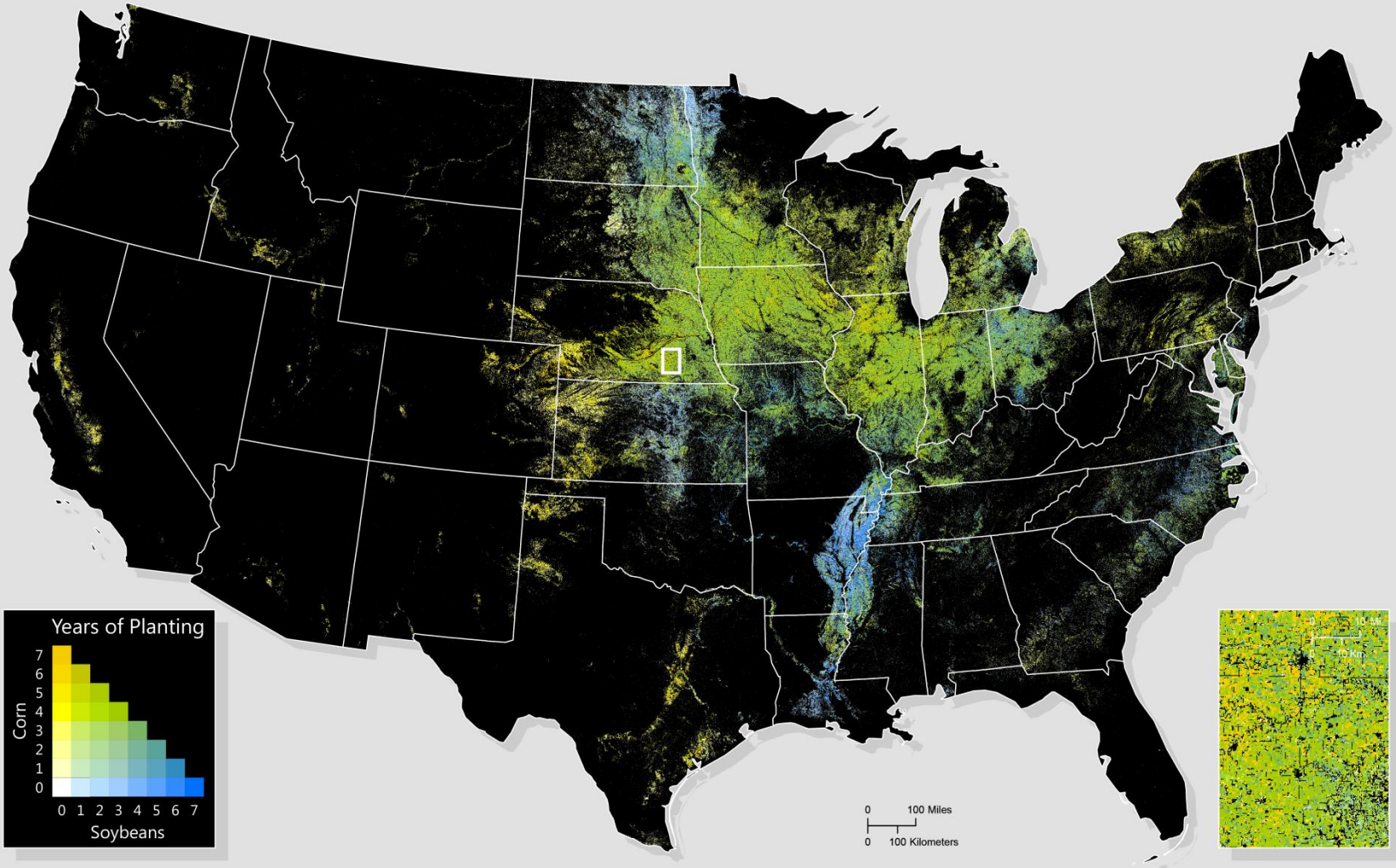


NLCD 2011

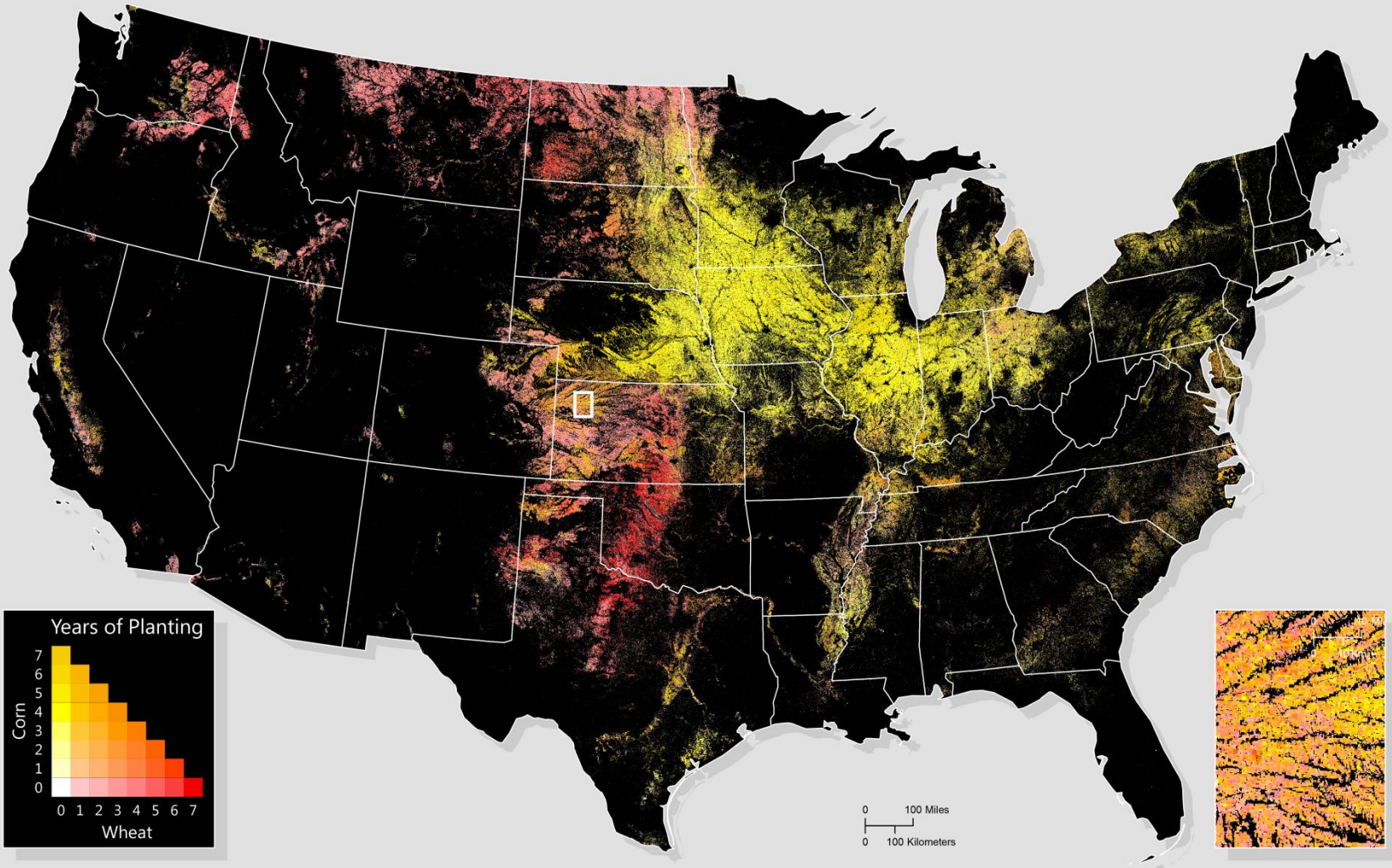
CDL derived *circa* 2012



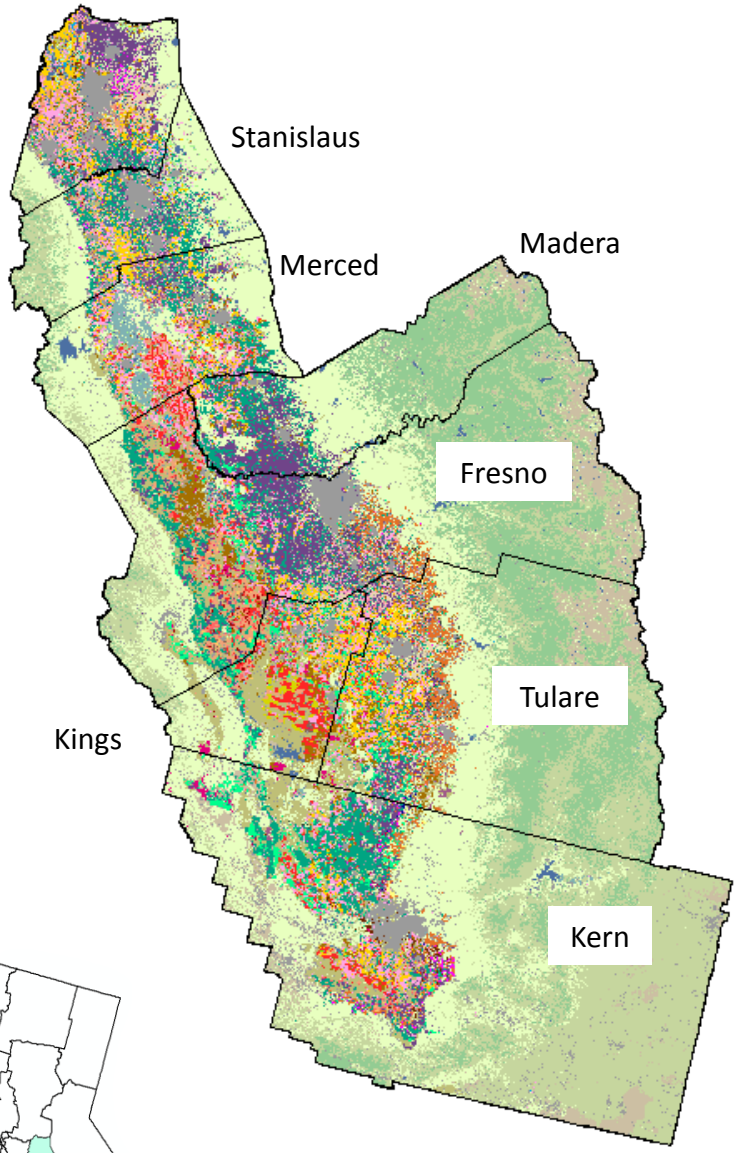
Corn & Soybeans
Planting Frequeny Data Layers 2008 - 2014

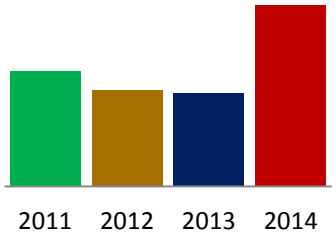


Corn & Wheat
Planting Frequency Data Layers 2008 - 2014



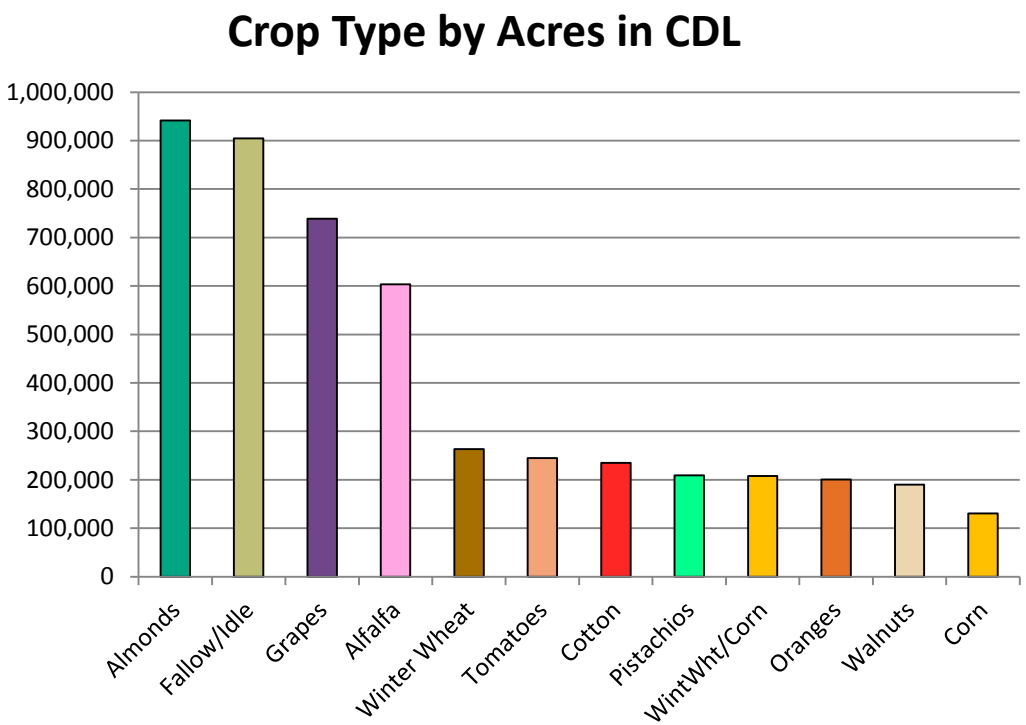
Cropland Abandonment
San Joaquin Valley





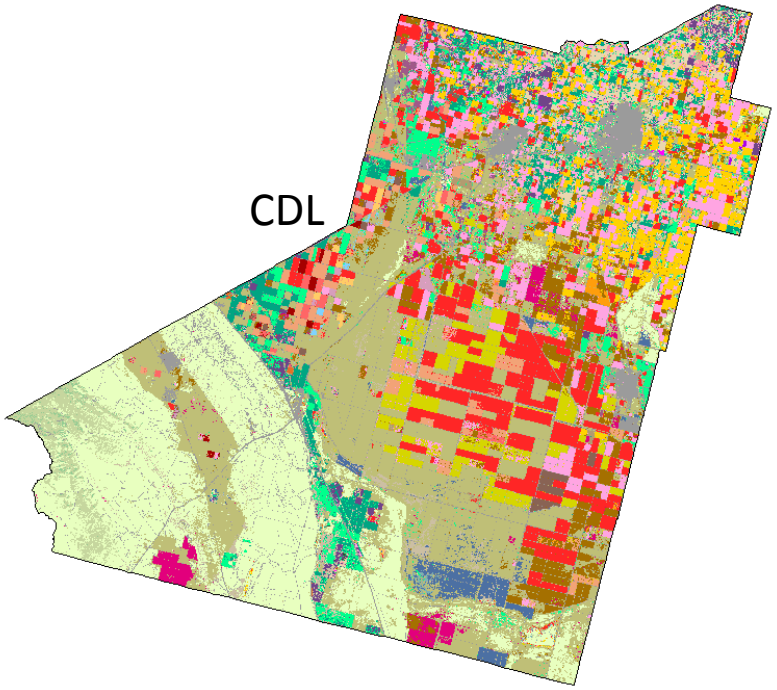
8 Counties with large amounts of agricultural

Investigate how the Fallow/Idle acres in each county have been changing over the last 4 years

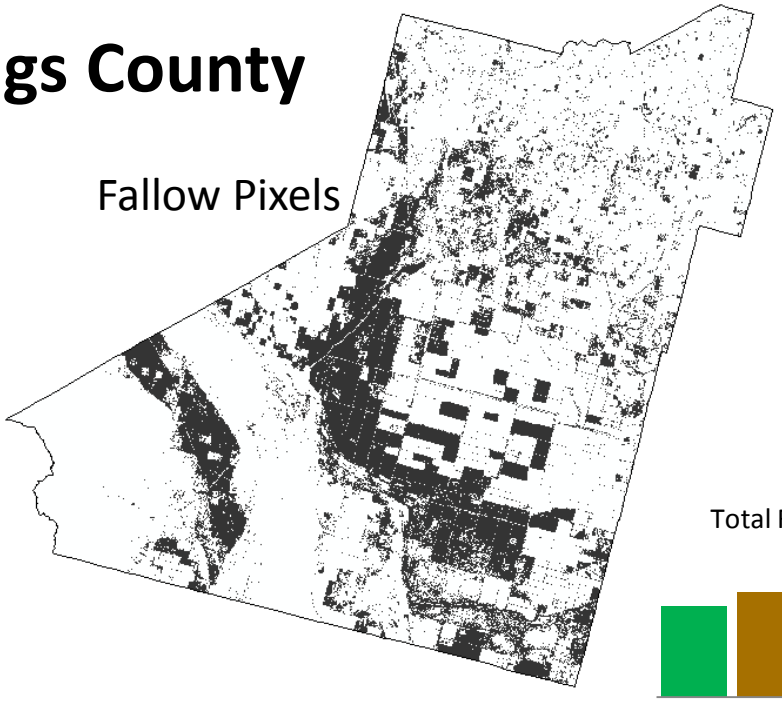


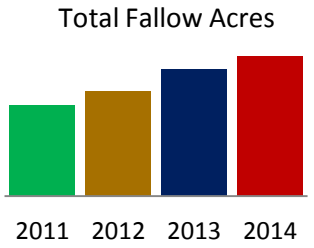
Kings County

CDL

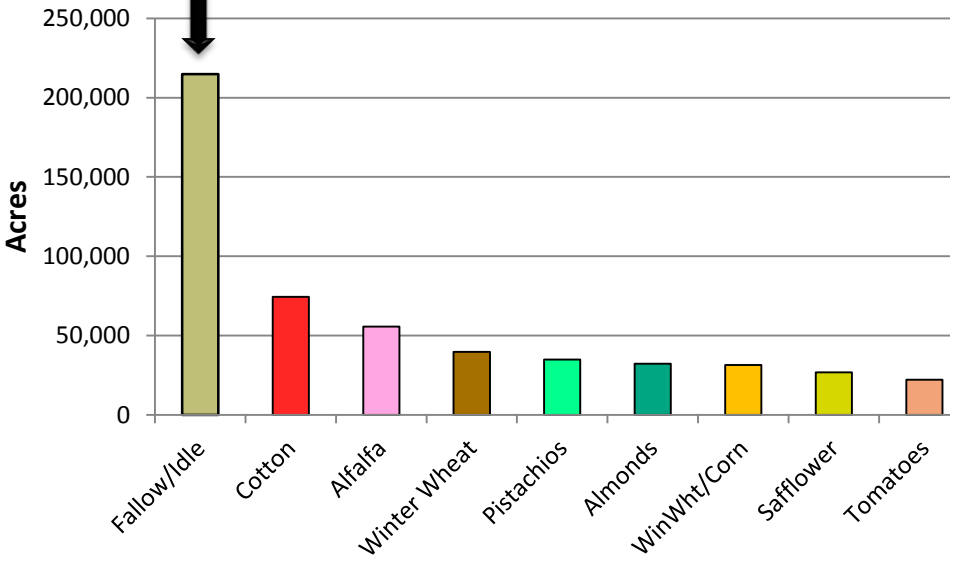


Fallow Pixels

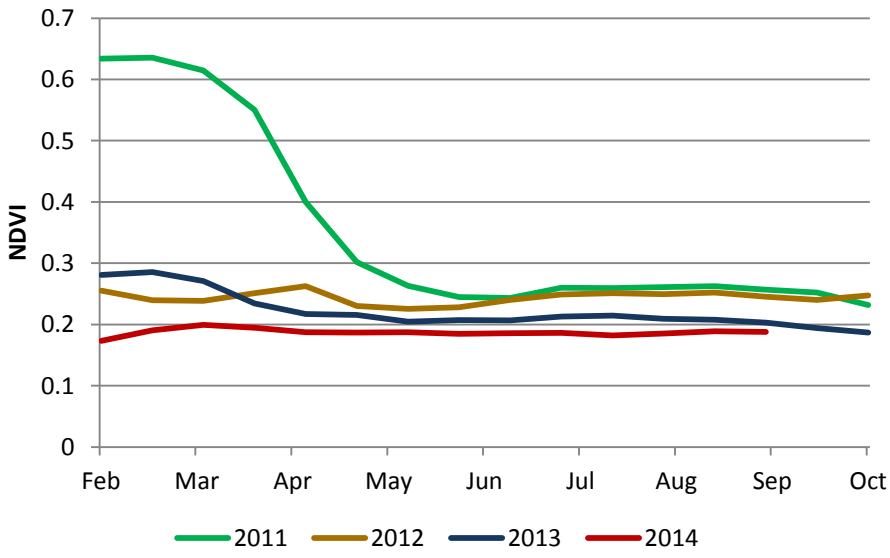




Crop Types by Acres in CDL



Fallow NDVI by Year



NASS Crop Production reports

Corn Area Planted for All Purposes and Harvested for Grain, Yield, and Production – States and United States: 2009-2011 (continued)

State	Yield per acre			Production		
	2009	2010	2011	2009	2010	2011
	(bushels)	(bushels)	(bushels)	(1,000 bushels)	(1,000 bushels)	(1,000 bushels)
Alabama	108.0	116.0	114.0	27,000		
Arizona	175.0	210.0	180.0	3,500		
Arkansas	148.0	150.0	142.0	60,680		
California	180.0	195.0	185.0	28,800		
Colorado	153.0	151.0	133.0	151,470		
Connecticut [1]	(NA)	(NA)	(NA)	(NA)		
Delaware	145.0	115.0	130.0	23,635		
Florida	100.0	105.0	100.0	3,700		
Georgia	140.0	145.0	158.0	51,800		
Idaho	180.0	180.0	185.0	14,400		
Illinois	174.0	157.0	157.0	2,053,200		
Indiana	171.0	157.0	146.0	933,660		
Iowa	182.0	165.0	172.0	2,420,600		
Kansas	155.0	125.0	107.0	598,300		
Kentucky	165.0	124.0	139.0	189,750		
Louisiana	132.0	140.0	135.0	80,520		
Maine [1]	(NA)	(NA)	(NA)	(NA)		
Maryland	145.0	106.0	109.0	61,625		
Massachusetts [1]	(NA)	(NA)	(NA)	(NA)		
Michigan	148.0	150.0	153.0	309,320		
Minnesota	174.0	177.0	156.0	1,244,100		
Mississippi	126.0	136.0	128.0	87,570		
Missouri	153.0	123.0	114.0	446,760		
Montana	152.0	135.0	130.0	3,952		
Nebraska	178.0	166.0	160.0	1,575,300		
Nevada [1]	(NA)	(NA)	(NA)	(NA)		
New Hampshire [1]	(NA)	(NA)	(NA)	(NA)		
New Jersey	143.0	114.0	123.0	10,010		
New Mexico	185.0	180.0	180.0	9,250		
New York	134.0	150.0	133.0	79,730		
North Carolina	117.0	91.0	84.0	93,600		
North Dakota	115.0	132.0	105.0	200,100		
Ohio	174.0	163.0	158.0	546,360		
Oklahoma	105.0	130.0	90.0	33,600		
Oregon	215.0	200.0	215.0	6,880		
Pennsylvania	143.0	128.0	111.0	131,560		
Rhode Island [1]	(NA)	(NA)	(NA)	(NA)		
South Carolina	111.0	91.0	65.0	35,520		
South Dakota	151.0	135.0	132.0	706,680		
Tennessee	148.0	117.0	131.0	87,320		
Texas	130.0	145.0	93.0	254,800		
Utah	155.0	172.0	164.0	2,635		
Vermont [1]	(NA)	(NA)	(NA)	(NA)		
Virginia	131.0	67.0	118.0	43,230		
Washington	215.0	205.0	225.0	22,575		
West Virginia	126.0	90.0	114.0	3,780		
Wisconsin	153.0	162.0	156.0	448,290		
Wyoming	140.0	121.0	130.0	6,300		
United States	164.7	152.8	147.2	13,091,862		

(NA) Not available.
[1] Area harvested for grain not estimated.

Crop Production 2011 Summary (January 2012)
USDA, National Agricultural Statistics Service

USDA

Crop Production

ISSN: 1936-3737

Released August 11, 2011, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, United States Department of Agriculture (USDA).

Planted Acreage Update

Survey respondents who reported acreage as not yet planted in Minnesota, Montana, North Dakota, and South Dakota during the survey conducted in preparation for the *Acreage* report, released June 30, 2011 were re-contacted in July to determine how many of those acres were planted or still intended to be planted. Acreage estimates in this report reflect this updated information.

Corn Production Up 4 Percent from 2010
Soybean Production Down 8 Percent from 2010
Cotton Production Down 9 Percent from 2010
All Wheat Production Down 1 Percent from July Forecast

Corn production is forecast at 12.9 billion bushels, up 4 percent from 2010. If realized, this will be the third largest production total on record for the United States. Based on conditions as of August 1, yields are expected to average 153.0 bushels per acre, up 0.2 bushel from 2010, and the fourth highest yield on record. Acreage planted for all purposes is estimated at 92.3 million acres, unchanged from the June estimate. Area harvested for grain is forecast at 84.4 million acres, down less than 1 percent from June but up 4 percent from 2010.

Soybean production is forecast at 3.06 billion bushels, down 8 percent from last year. Based on August 1 conditions, yields are expected to average 41.4 bushels per acre, down 2.1 bushels from last year. Area for harvest in the United States is forecast at 73.8 million acres, down less than 1 percent from June and down 4 percent from 2010. Planted area for the Nation is estimated at 75.0 million acres, down fractionally from June.

All cotton production is forecast at 16.6 million 480-pound bales, down 9 percent from last year's 18.1 million bales. Yield is expected to average 822 pounds per harvested acre, up 10 pounds from last year. Upland cotton production is forecast at 15.8 million 480-pound bales, down 10 percent from 2010. American Pima production is forecast at 737,200 bales, up 46 percent from last year. Producers expect to harvest 9.67 million acres of all cotton, down 10 percent from 2010. This harvested total includes 9.38 million acres of Upland cotton and 287,500 acres of Pima cotton.

All wheat production, at 2.08 billion bushels, is down 1 percent from the July forecast and down 6 percent from 2010. Based on August 1 conditions, the United States yield is forecast at 45.2 bushels per acre, up 0.6 bushel from last month but down 1.2 bushels from last year.

USDA
United States Department of Agriculture
National Agricultural Statistics Service

Crop Production
2011 Summary

January 2012

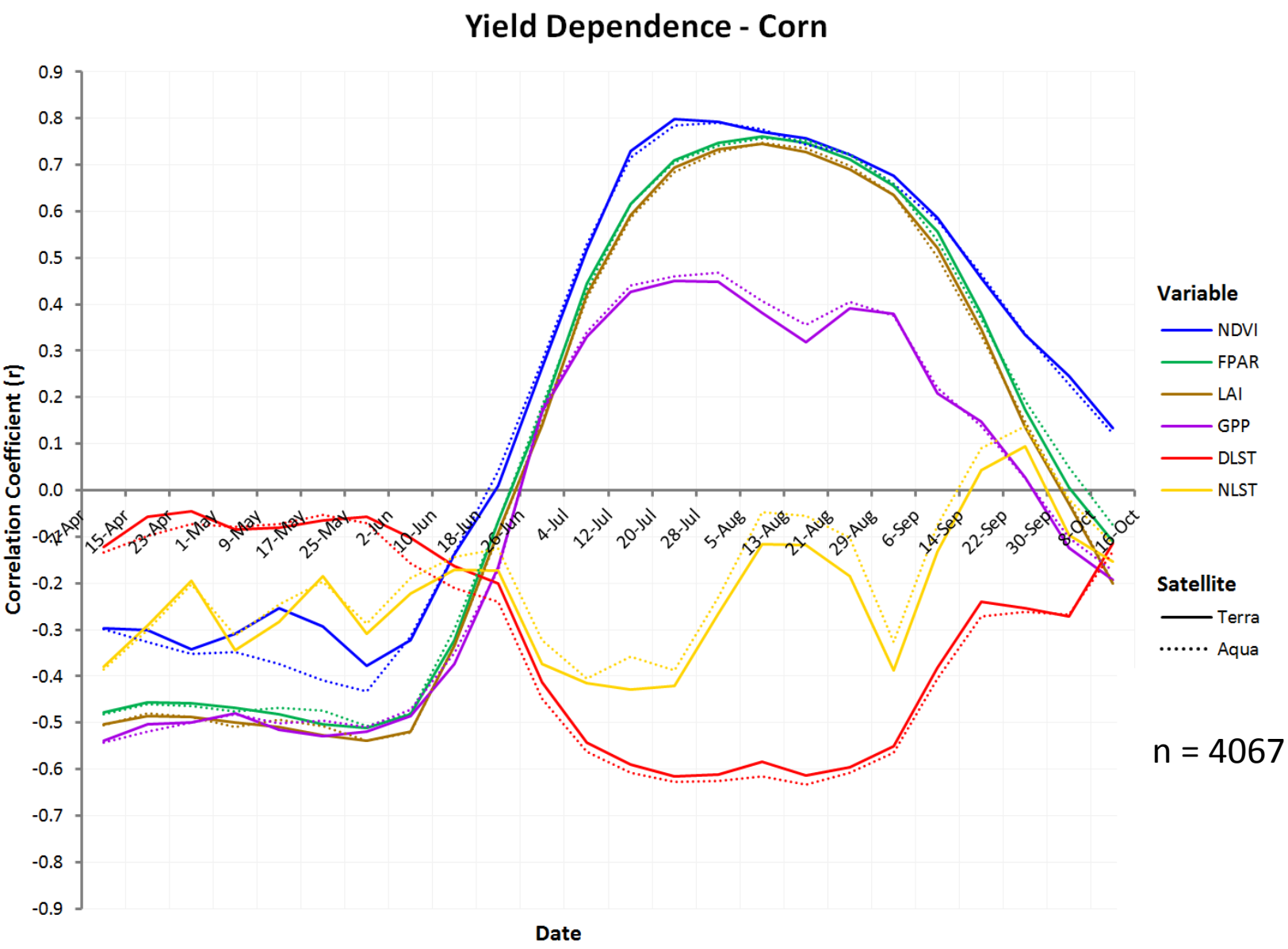
ISSN: 1057-7823

USDA

Published no later than the 12th of each month.

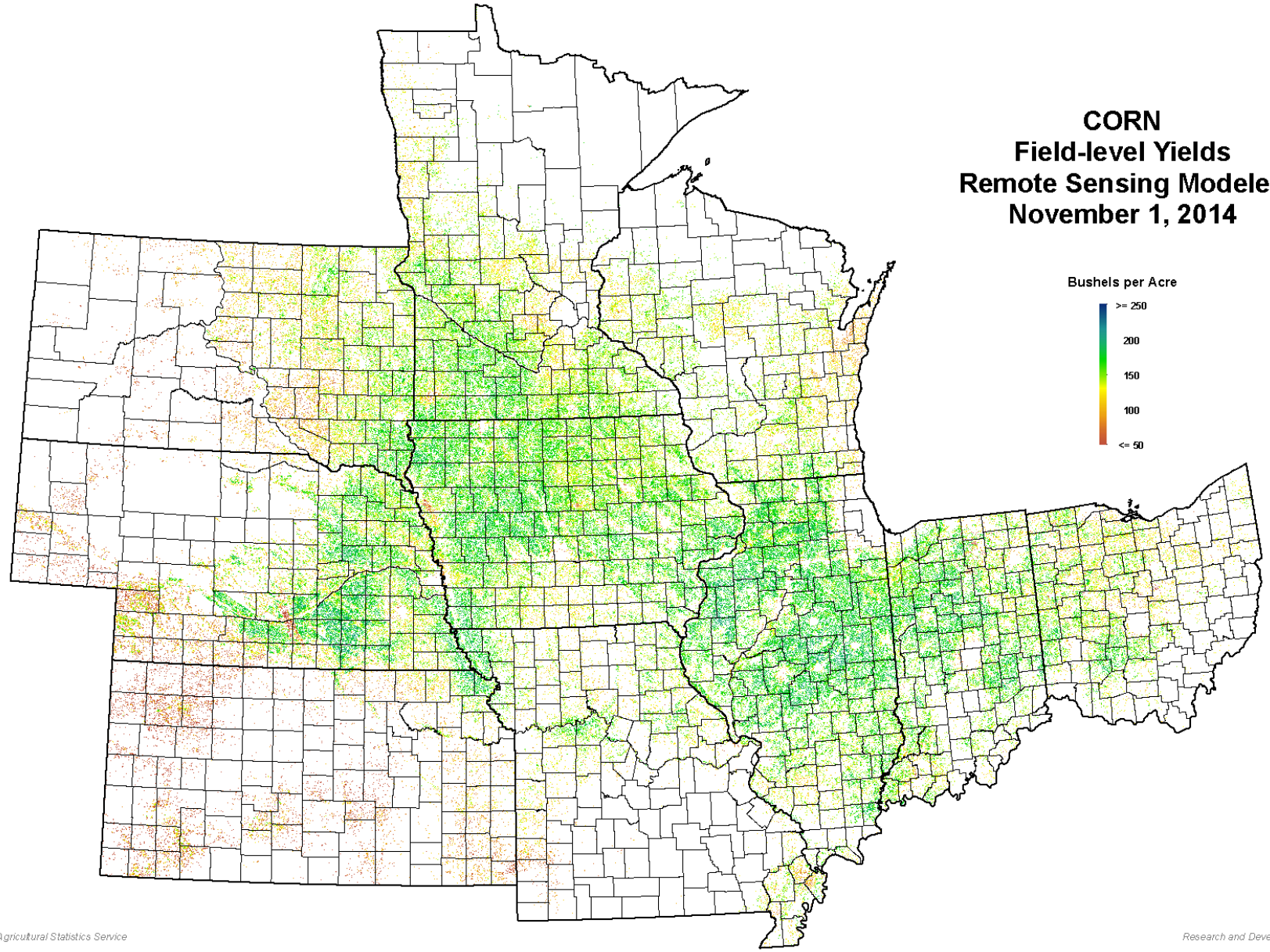
Noon Eastern US release time

8-Day MODIS Correlations



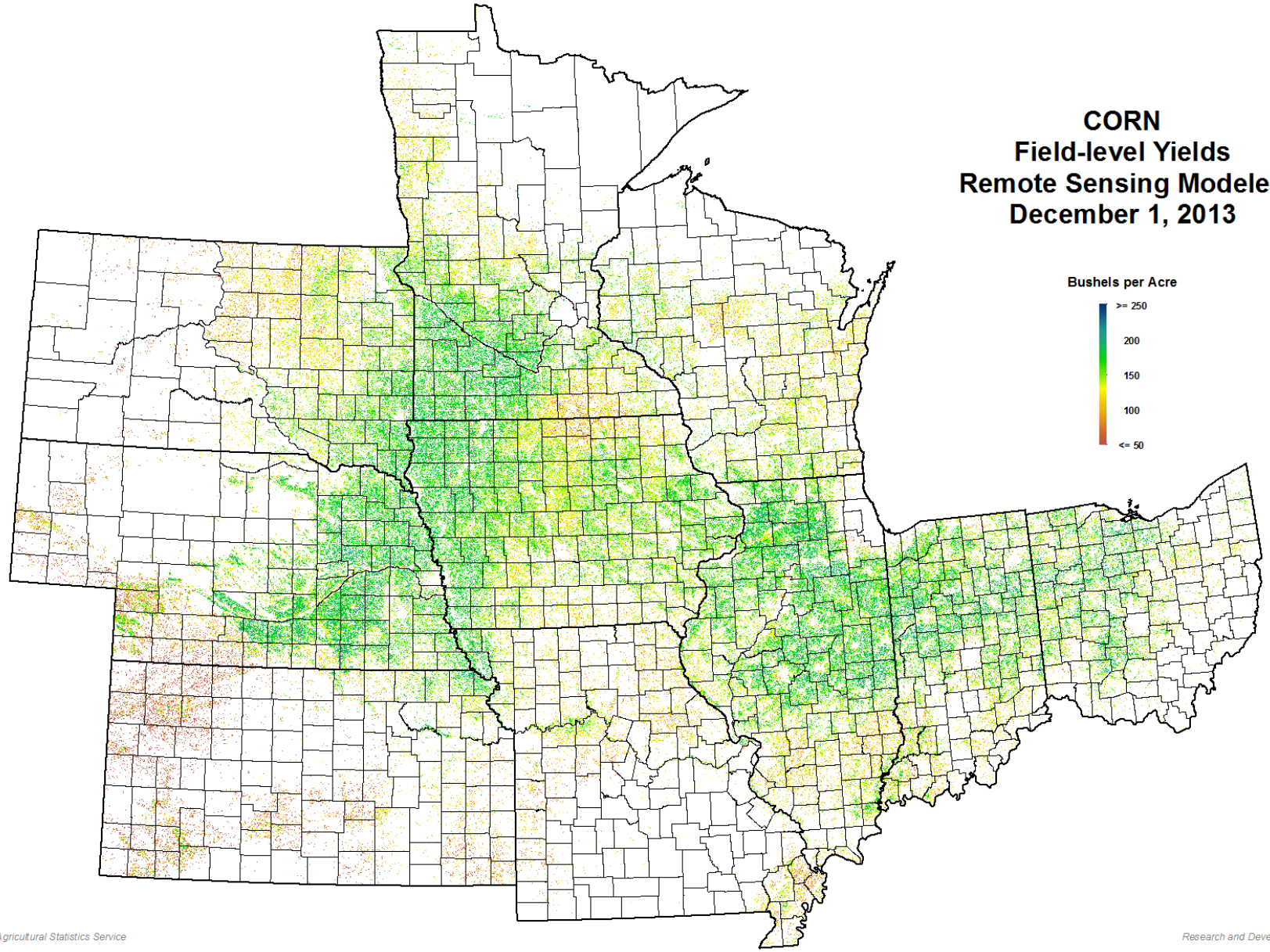
n = 4067

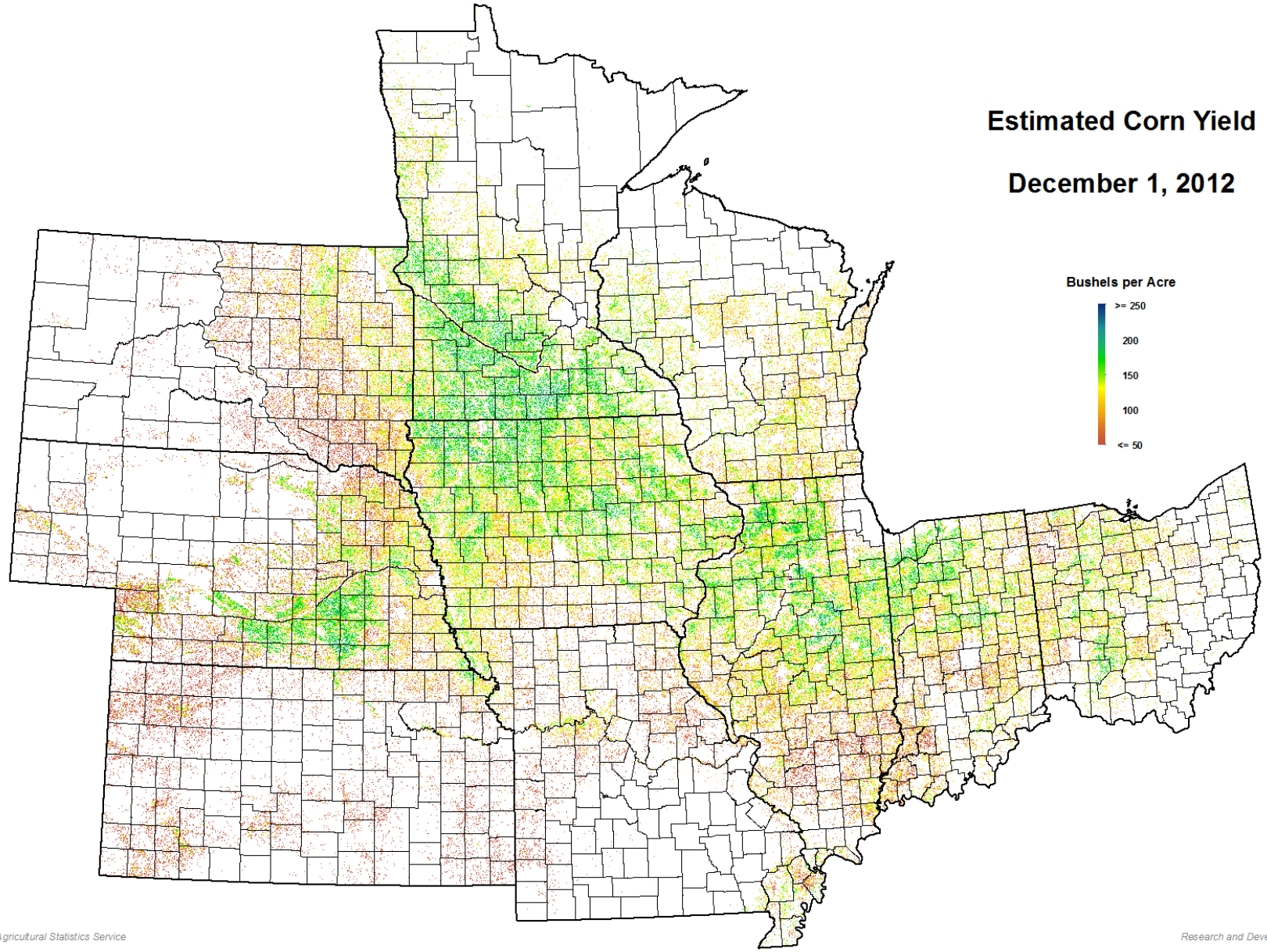
Johnson, in prep.



USDA/National Agricultural Statistics Service

Research and Development Division

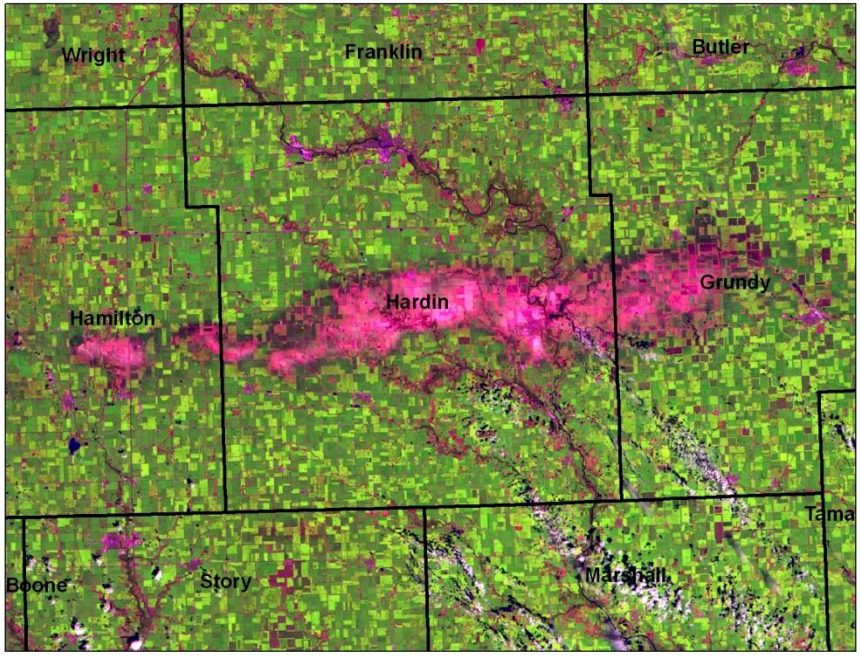

CORN
Field-level Yields
Remote Sensing Modeled
December 1, 2013
Bushels per Acre
>= 250
200
150
100
<= 50
USDA/National Agricultural Statistics Service
Research and Development Division



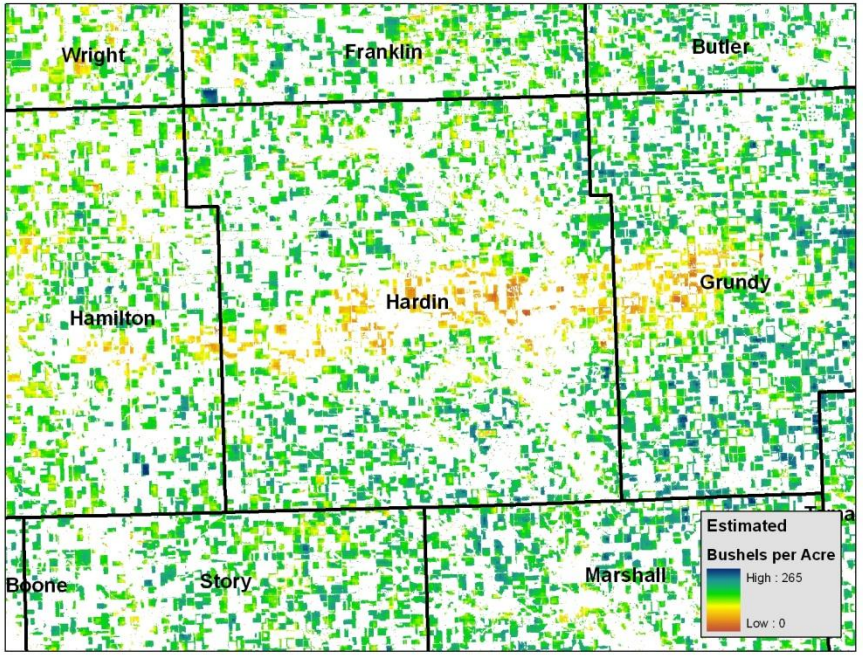
Johnson, 2014

Localized example of yield map variability

Scene of a large hailstorm

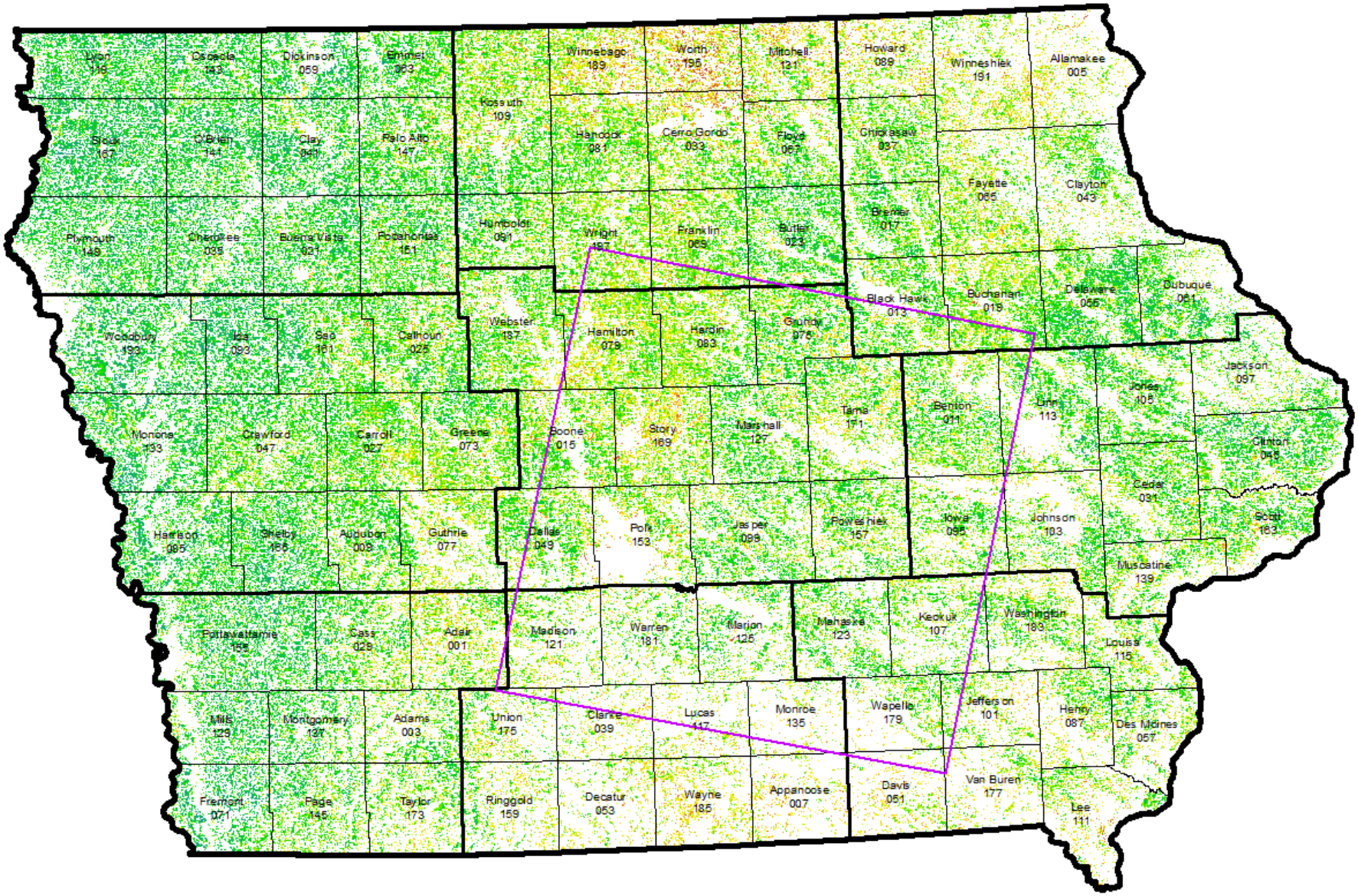


Landsat image

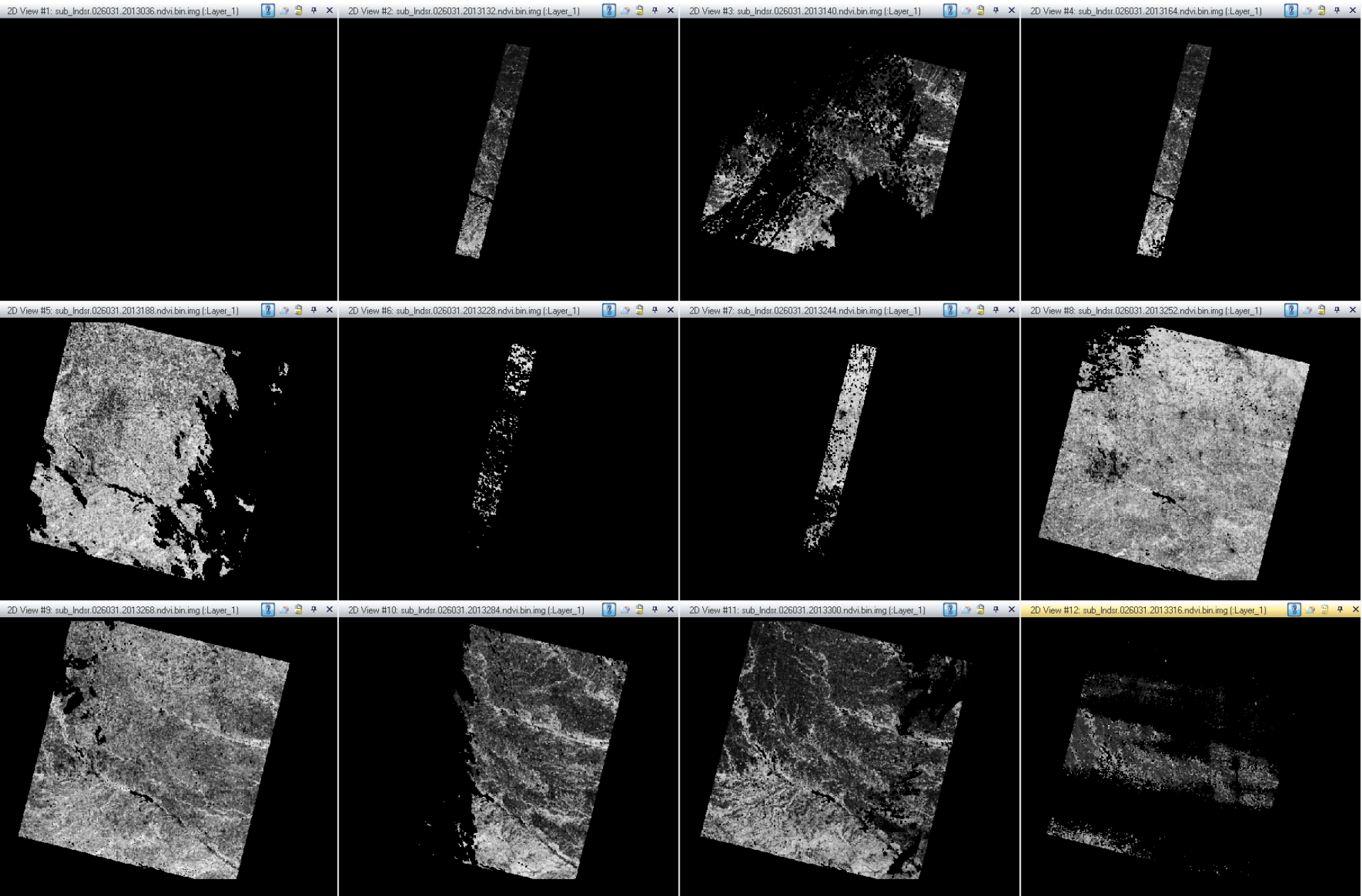


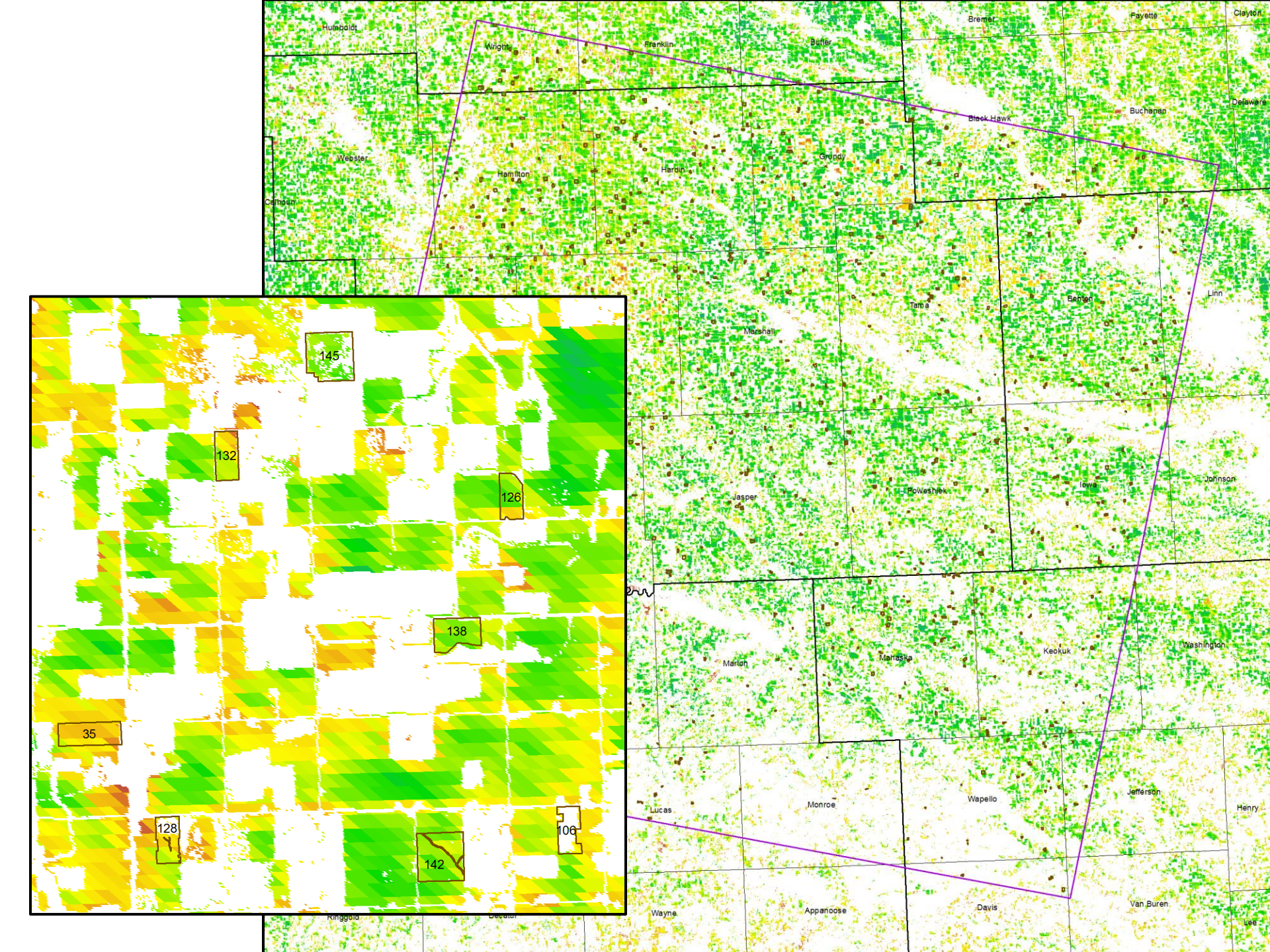
Modeled yields from MODIS

Integrating Landsat study site, p26 r31

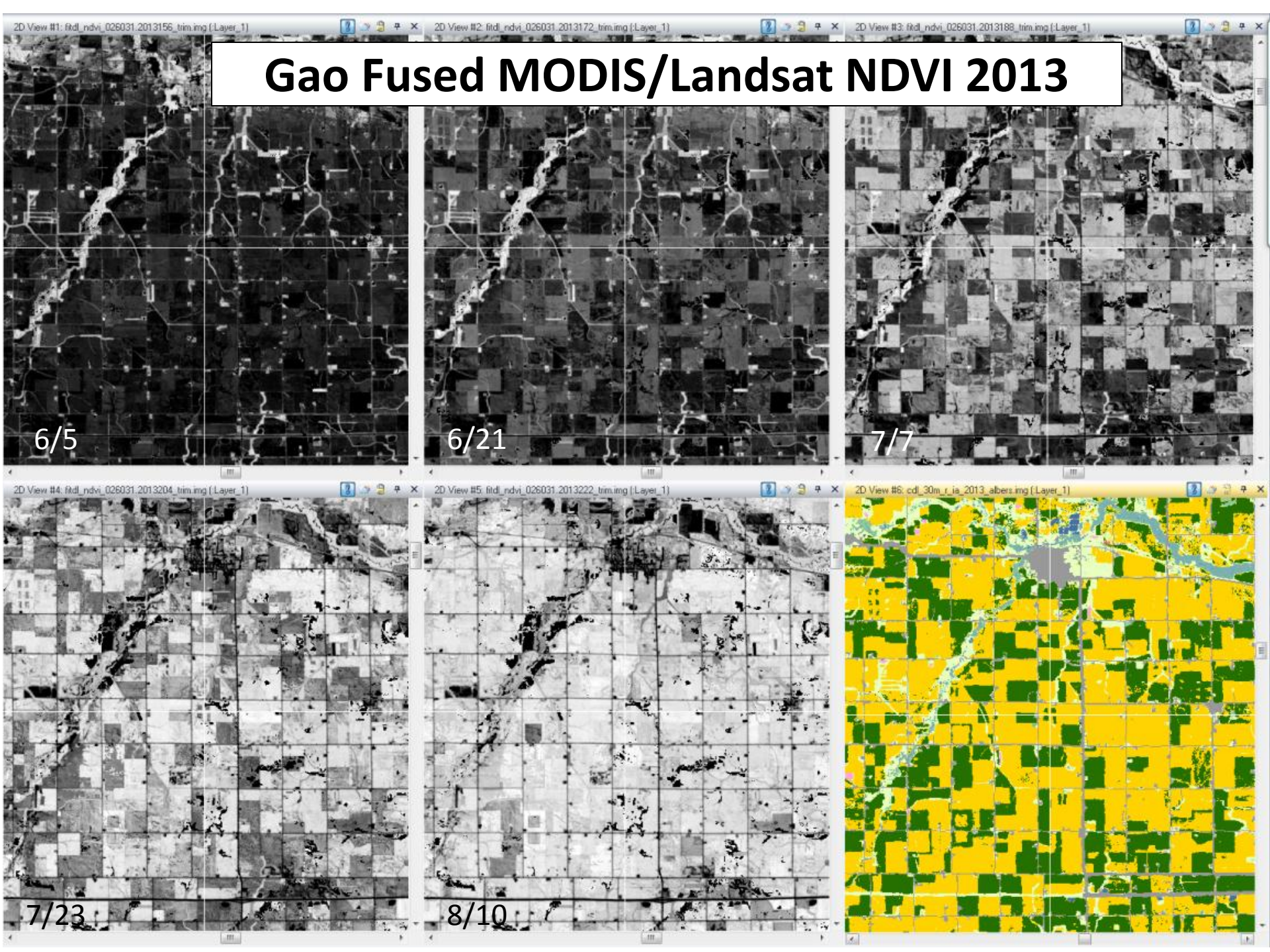


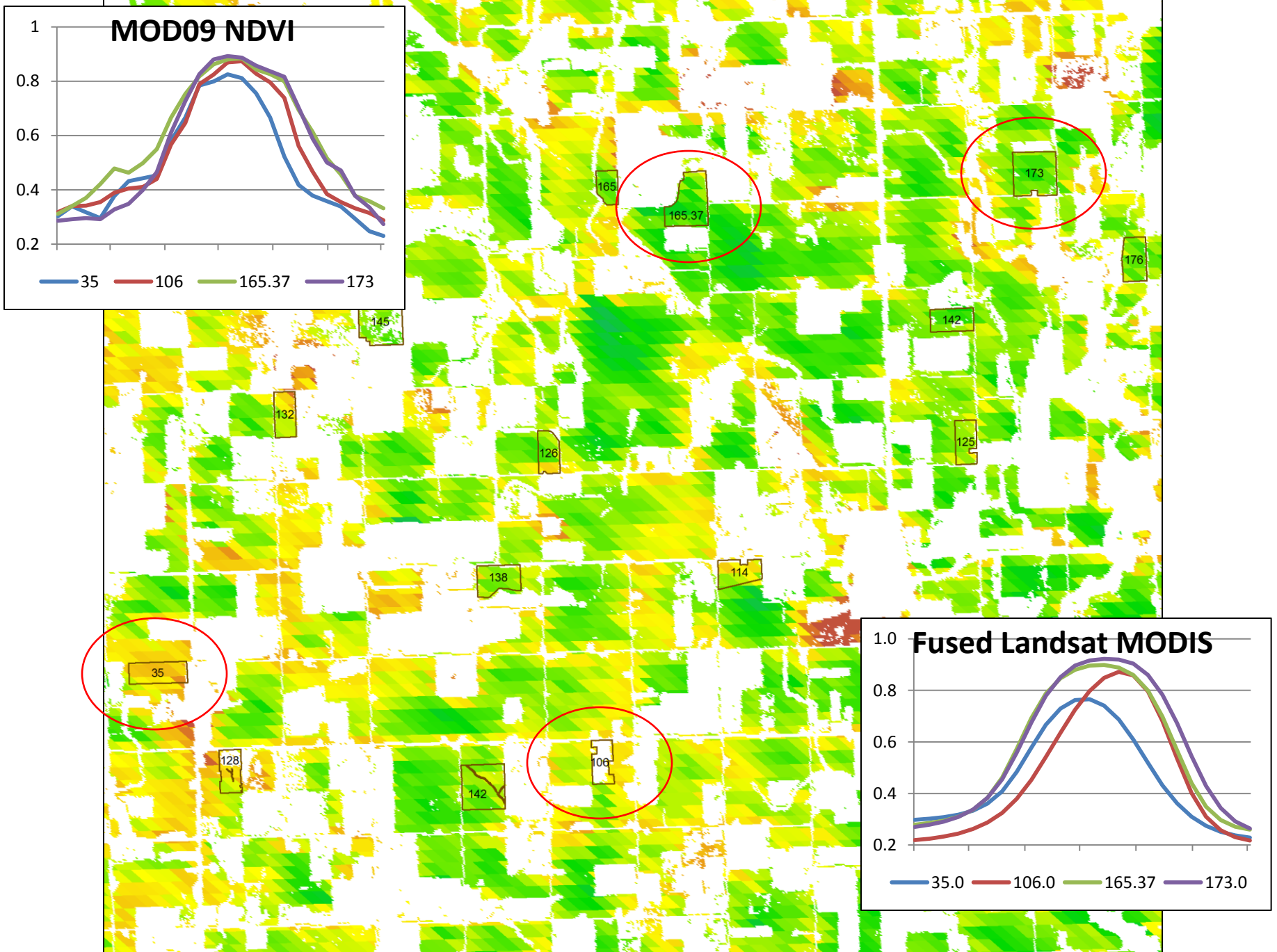
L7 and L8 p26 r31 NDVI 2013 growing season

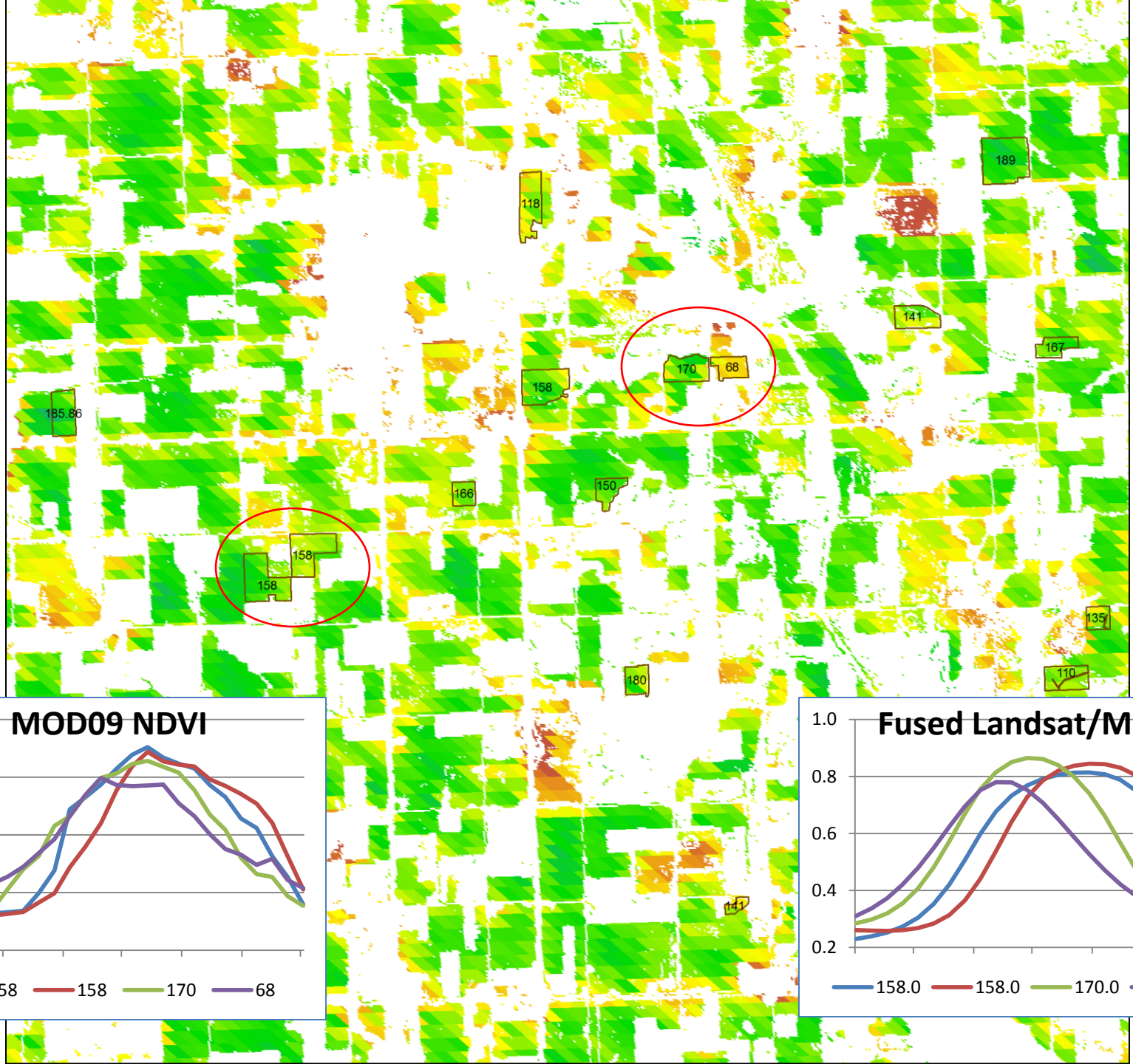



Humboldt
Wright
Franklin
Butler
Bremer
Fayette
Clayton
Webster
Hamilton
Hardin
Grundy
Black Hawk
Buchanan
Delaware
Calhoun
Tama
Benton
Linn
Marshall
Jasper
Poweshiek
Iowa
Johnson
Marion
Mahaska
Keokuk
Washington
Lucas
Monroe
Wapello
Jefferson
Henry
Wayne
Appanoose
Davis
Van Buren
Lee
Ringgold
Decatur
145
132
126
138
35
128
142
106

Gao Fused MODIS/Landsat NDVI 2013




MOD09 NDVI
1
0.8
0.6
0.4
0.2
35
106
165.37
173
Fused Landsat MODIS
1.0
0.8
0.6
0.4
0.2
35.0
106.0
165.37
173.0
165
165.37
173
176
145
142
132
126
125
138
114
35
128
142
106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185.66
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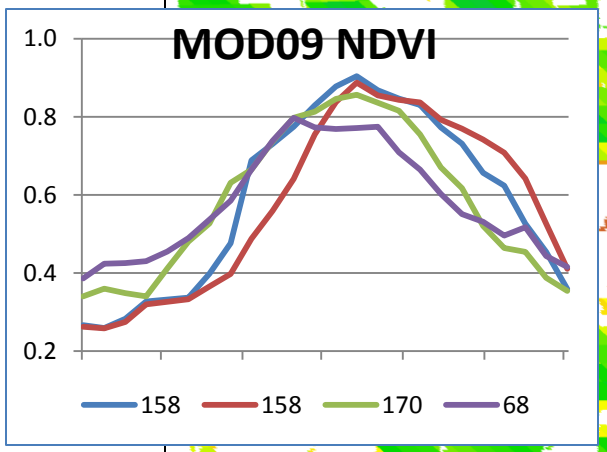
158
135
180
110
141


MOD09 NDVI
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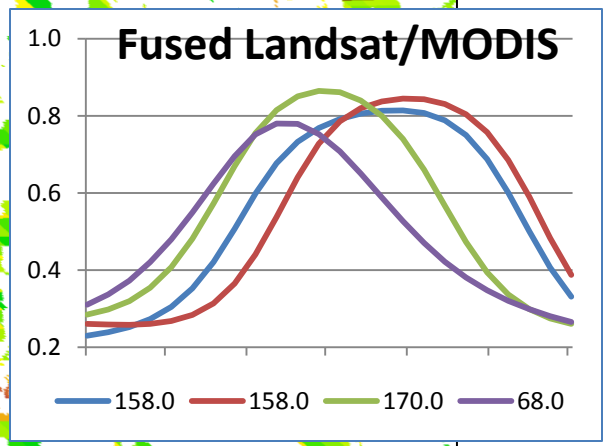
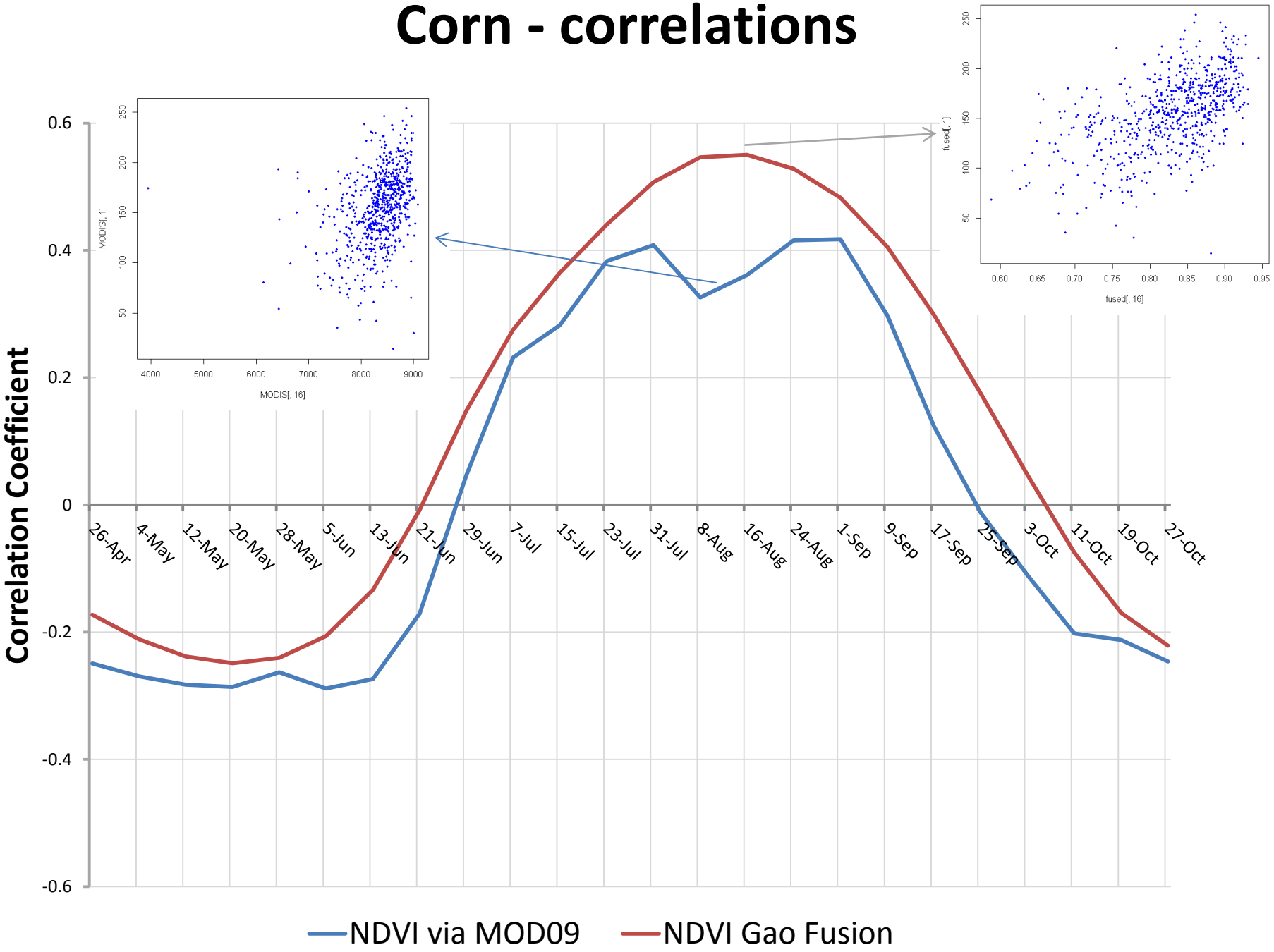
0.8
0.6
0.4
0.2
158
158
170
68


Fused Landsat/MODIS
1.0
0.8
0.6
0.4
0.2
158.0
158.0
170.0
68.0

Corn - correlations



Thanks

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